FFMPA

Flash Flood Monitor and Prediction: Advanced

Graphical User Interface

Guide for Users

version **OB9**

October 2, 2008

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-WHAT'S NEW?-

- **Alternate Basin Trend Graphs**
  When QPF was added to the Basin Trends in OB8.3, it added another layer of complexity to an already complex graph. It was decided to provide, in addition to the existing graph, graphs with an alternate appearance. See the Alternate Basin Trend Graph section for details on the pros/cons of the Alternate Basin Trend Graphs.

- **Enhanced RFC FFG Update Handling**
  When the previous version of FFMP received an RFC FFG update, it would use it immediately, which created a situation where precipitation may get counted twice, thus over emphasizing the flash flood threat. As of OB9, FFMP will delay the usage of the RFC FFG update, as well as apply an intelligent transition scheme that yields more realistic and valuable RFC FFG. See the RFC FFG Update Handling section for details.

- **Basin Trace Clear Method**
  There is now a "Clear" button in the Basin Table that clears any Basin Trace in the D2D. This will allow you to see a Basin trace with other interactive components, like WarnGen. See the Basin Trace and Utility Bar sections.

- **Forced FFG GUI Clear Method**
  The Forced FFG GUI now has a method to immediately clear all previously forced data. See the Forced FFG GUI User's Guide for details.

- **Stream Link Map**
  (Bug fix) The FFMP -ffmp localization now correctly copies the stream link map file (FFMP_ref_sl.bcd file) properly, so that it is visible from all workstations. This means that the stream link map is once again usable from the Map menu in the D2D without any manual file copying.

- **HTML FFMP Data Monitor**
  (Bug fix) The various issues with the FFMP HTML Data Monitor should be resolved, with the page now fully operational.

-INTRODUCTION-

The Flash Flood Monitoring and Prediction (FFMP) system is an integrated suite of multi-sensor applications which detects, analyzes, and monitors precipitation and generates short-term warning guidance for flash flooding automatically within AWIPS. FFMP will provide forecasters with accurate, timely, and consistent guidance and supplement forecaster event monitoring with multi-sensor, automated event monitoring. The intended benefits are:

- Longer lead times on warned events
- Fewer missed events
- Increased forecaster situational awareness
- Reduced forecaster fatigue during warning situations

FFMP conducts its precipitation analyses in a "basin world", which means all calculations are done over the areas of mall basins.

FFMP Advanced has been expanded on the previous version of FFMP in several ways. See the What's New section for a summary.

FFMP Advanced Components

FFMPA has the same components as the old FFMP:

- FFMPprocessor: Ingests AWIPS data from its native domain into FFMP, writes out FFMP data in the Basin domain, and performs the Monitor function of FFMP. This runs on *px1* and can be stopped or started as user *fxa* with the commands:

      stopFFMPprocessor
      startFFMPprocessor

  If you want FFMP to produce both binary and **text** files (for easy examination), define the environmental variable **FFMP_TEXT** to be 1 before starting the FFMPprocessor. To turn text files back off, stop FFMPprocesor, un-set FFMP_TEXT, then re-start FFMPprocessor.

- FFMPA Display: The D2D color images and the Basin Table (as well as maps), launched from the FFMP section of the SCAN menu.

- Flash Flood Threat Indicator (FFTI) GUI: This is where you tell FFMP what and how to monitor. Any user can launch this from the FF button in the Guardian main window, but there is only one set of Monitor Sets applied at any given time for the WFO.

- Forced Flash Flood Guidance (FFFG) GUI: You can force FFMPA to use user-defined values for a given Guidance data source, for your entire domain, or for individual counties, or for individual basins. Any user can launch this from the command line on any machine with the command:

      ForcedFFG.tcl

The New FFMPA Data Tree

In the old FFMP, the data FFMP generated was written to and scattered in various radar data trees. In FFMPA, the basin data FFMPA generates has been written to its own FFMP data tree:

      $FXA_DATA/ffmp

Under this tree, you will see data directories for each QPE source that has been defined (see the Data Source Configuration section), and under those, you will see various directories for non-QPE data sources and various lookups. (Yes, there is data duplication for non-QPE data sources, but this was necessary in order to maintain our 'lookup design', which is essential for good performance.) All FFMPA data files are time-stamped binary data files. The lookups are text files with various names.

The Idea of a Split Window

You will see or hear the term "Split Window" often, in FFMPA. A Split Window is a Time Frame or Time Duration that has been split between QPE and QPF. This will allow FFMPA to provide more of a 'predictive' quality to its guidance and data displays.

For example: You can add 1-hour QPF to 2-hour QPE and compare it to 3-hour Guidance, which, assuming you trust these three data sources, may allow the forecaster to make that warning decision sooner and with more confidence, thus providing more lead time.

Displaced Real Time (DRT)

FFMPA will provide the most value when the weather has a potential for flash flooding. Because of this, many potential FFMPA users do not attempt to use it until the weather has that flash flood potential, and some WFOs will not experience such conditions for many months (or more). This leads to a lack of familiarity with FFMPA and what it can and cannot do, and can lead to difficulties or discomfort when using FFMPA during potential flash flood events. There is also a high degree of value in being able to review a past case in FFMPA and to be able to train in FFMPA, if the WFO so desires.

Because of these reasons, FFMPA provides a DRT method. The old FFMP did too, but now that FFMPA allows for more varied and flexible data source combinations, the DRT method had to be enhanced.

Please see the FFMP DRT Instructions document for details on how to run DRT sessions for FFMPA.

RFC FFG Update Handling

As of OB9, FFMPA data sources that are RFC-issued FFG will update differently in FFMPA. To avoid double-counting of precipitation accumulation and to provide more of a transition (as opposed to possibly abrupt, drastic changes in FFG values), FFMPA will apply two rules to the ingest of RFC FFG:

- Delay the usage of the issued FFG values from the valid time of the RFC FFG, a number of hours equal to the time frame of the FFG. For example: 3hr FFG issued at 00Z will not be used until 03Z.
- For times in between the delayed time and the issued time, apply transition logic such that:
    o The transition values are between the previous value and the newly updated values (inclusive).

- o When FFG decreases, the amount of transition will be dependent upon previous accumulations.
- o When FFG increases, the amount of transition will be dependent upon the update cycle frequency.
- o For detailed equations and images, see the FFMPA OB9 Design Review document available on the FFMPA web page.

If you do not wish to make use of this new FFG Update handling method, you can turn it off by creating a file called:

> **`/data/fxa/customFiles/FFMP_FFGupdate.txt`**

with the contents:

> **`delay:0`**
> **`transition:0`**

You can also keep the delay but exclude the transition by turning delay on, like this:

> **`delay:1`**
> **`transition:0`**

-CUSTOMIZATION: SET UP-

Small Basin Shape Files

- FFMPA uses only one domain. This means there is only one `FFMP_aggr_basins.*` shape file set and only one `FFMP_ref_sl.*` shape file set.
- FFMPA **requires the aggr_basins set**, but the ref_sl set is only required for the Basin Trace function. If you do not have the ref_sl set, then the only thing you will not be able to do in FFMP is produce a Basin Trace.
- FFMPA Small Basin shape files are obtained from an NSSL web page, with online instructions: http://nmqxrt-29.nssl.noaa.gov/Website/ffmp_nbr
- All shape files are to be placed in AWIPS in `$FXA_DATA/nationalData` before FFMP localization.

The Data Source Configuration File

(NOTE: It Is likely individual FFMP users will not need to be concerned about this file at all. This is more of a WFO or Hydro Focal point concern.)

FFMP is driven by the aggr_basins shape file set and the data source configuration file: `$FXA_DATA/FFMPsourceConfig.dat`. This file contains a listing of data sources FFMP will attempt to recognize and use, with information that will allow FFMP to ingest native data and transform into basin data for use by FFMP's displays. There is a separate document that described the content of this file. See the FFMP web page for details.

Add/Remove Data Source

If you want FFMP to make use of a new data source, or to remove a data source you think is no longer valid, you need to manually edit this configuration file. (A GUI wrapper is intended to be developed at some point.) To remove, simply delete the single-line entry for the data source of interest. To add, see the separate document that describes the content of the configuration file which is available on the FFMP web page. Note in that document which domains are usable in FFMPA. **Once this file has changed, you will need to re-localize for FFMP and re-start the notificationServer**!

Add/Remove CWA

If you want to change your domain of interest (which should include your CWA and the CWAs of any potential Service Backup areas), edit the CWA line in this configuration file. Once this file has changed, you will need to re-localize for FFMP.

Localization

$FXA_HOME/data/localization/scripts/mainScript.csh -ffmp

FFMP localization does more now than it did in the past. FFMP's localization is office-wide, meaning no workstation localization is needed. One localization works for all machines and can accommodate Service Backup. Executing the –ffmp localization switch on **dx1** as user **fxa** will:

- Manage (create/delete) $FXA_DATA/ffmp/* data directory tree.
- Delete all binary basin data files in $FXA_DATA/ffmp/* and $FXA_DATA/ffmp/*/*.
- Create performance-saving lookups for all data sources listed in $FXA_DATA/ffmp/FFMPsourceConfig.dat.
- Create *.bcd map files for the aggr_basins and ref_sl shape file sets.
- Retrieve gages from hydro data base for use as VGBs.
- (Re-)Create the small basin GELT, which is used for the color image display in the D2D.

Service Backup

Assuming the data for your data sources of interest are being ingested by AWIPS and that the domains of these data sources are adequate to cover the domain of your Service Backup CWAs, FFMP can manage Service Backup on the fly. All you need to do is adjust the CWA filter settings in the FFTI GUI for monitoring, and in the Basin Table for display, and you can expand or contract the full domain that will be used by FFMP monitoring and display. See the respective sections of this User's Guide for details on the widgets in the GUIs.

Note that there is a push to get the DHR radar product put on the National RPS List, which will ensure that at least all radar data sources will be available to FFMP, assuming you have configured FFMP to recognize and use the pertinent radars. (See the data Source Configuration section.) At the writing of this document, the status of this push was unknown.
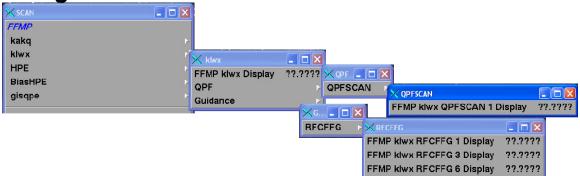
VGB: Use and Removal

FFMP will query the Hydro data base to see what rain gages may be of interest. For each of these identified gages, FFMP determines which single data source bin overlies the gage for each QPE data source of interest, and calls that bin a Virtual Gage Basin (VGB) and treats it like any other of the hydrologic basins in FFMP, including accumulation rules and trending, but *excluding monitoring*. The intent is to provide a method to compare gage accumulations to QPE data source accumulations in order to evaluate how well the QPE data source is doing when estimating precipitation. For example: this can be used to evaluate WSR-88D DHR-based accumulations.

If FFMP is including rain gages that you deem unimportant (for various reasons), you can remove the gages from FFMP consideration by adding the gage ID (one ID per text line) to the file **$FXA_DATA/ffmp/gageRemoved.txt** before localizing.

-FFMPA DISPLAY: D2D-

Starting FFMP

FFMP D2D menu selections still reside under the SCAN menu, but the contents have changed from the old FFMP. Each QPE data source defined in the Data Source Configuration file will have an entry in an FFMP section in the SCAN menu. And under that, you will find the main Display selection, and sub-menus for Independent Displays. The main Display selection launches the familiar Color Image and Basin Table.

When you load the main Display for a QPE data source, you will see the 'Loading' window while FFMP initializes itself. You may also see a pop-up message, if something unexpected happened, such as when no inventory (data) could be constructed.
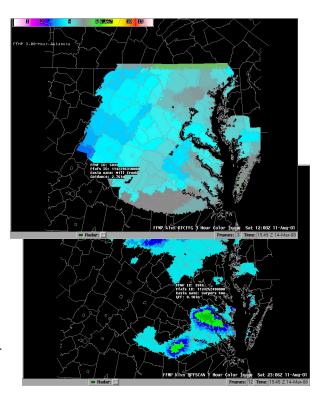
Independent Displays

(The image on the top shows 3-hr RFC FFG and the image on the bottom shows 1-hr SCAN QPF.)

The Independent Displays provide a color image of just the Non-QPE data source desired, in basin form, with no interactability and no Basin Table. For example – if you want to see how the 3-hour RFC FFG has been transformed into basin values, you can load the Independent Display for "RFCFFG 3 hr" and view color-filled basins.

Display Constituents

Once the main FFMP Display for a QPE source has been successfully loaded, you will see a Color Image and the Basin Table. See the two sections below for details.

Color Image

Once FFMP is loaded, either for the full FFMP display, or for one of the Independent

Displays, the D2D pane will contain a full color image of small basins. The coloring of these small basins will depend on the criteria for display, which will be noted in the upper left corner of the D2D pane, as a color table and additional text label. If the color image shows no color, check this extra label to see what display configuration settings are in use, which may correctly yield no values (or zero values) to color. The color image display also uses slightly different data rounding rules, such that zero values in the Basin Table may actually be greater than zero values in the color image, which yields color (not black).

These small basins may also be grouped, giving the appearance and values of aggregates like counties or HUC layers. Data sampling will yield some additional information, such as:

- data value for type with units
- Basin Pfafstetter Identifier

- FFMP basin index ID
- Basin Name
- County name
- County FIPS code
- HUC Identifier

Basin Table

The Basin Table window will be labeled with the parent QPE data source and display FFMP data. This is the primary interface for viewing and configuring FFMP data.

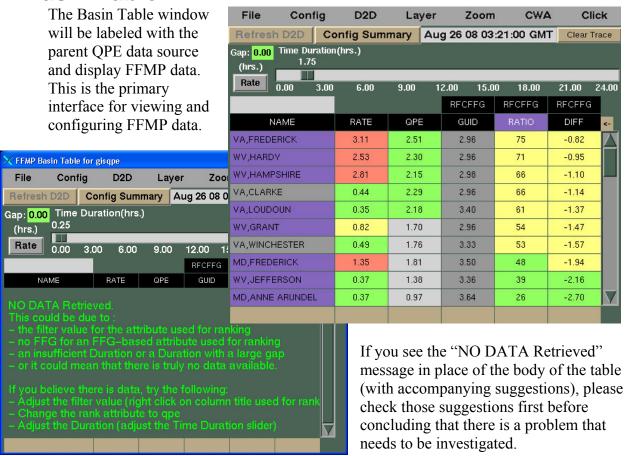| File	Config	D2D	Layer	Zoom	CWA	Click

Refresh D2D | Config Summary | Aug 26 08 03:21:00 GMT | Clear Trace

Gap: 0.00 (hrs.) | Time Duration(hrs.) 1.75

Rate | 0.00 3.00 6.00 9.00 12.00 15.00 18.00 21.00 24.00

NAME	RATE	QPE	RFCFFG GUID	RFCFFG RATIO	RFCFFG DIFF	<-
VA,FREDERICK	3.11	2.51	2.96	75	-0.82	
WV,HARDY	2.53	2.30	2.96	71	-0.95	
WV,HAMPSHIRE	2.81	2.15	2.98	66	-1.10	
VA,CLARKE	0.44	2.29	2.96	66	-1.14	
VA,LOUDOUN	0.35	2.18	3.40	61	-1.37	
WV,GRANT	0.82	1.70	2.96	54	-1.47	
VA,WINCHESTER	0.49	1.76	3.33	53	-1.57	
MD,FREDERICK	1.35	1.81	3.50	48	-1.94	
WV,JEFFERSON	0.37	1.38	3.36	39	-2.16	
MD,ANNE ARUNDEL	0.37	0.97	3.64	26	-2.70	

FFMP Basin Table for gisqpe

File	Config	D2D	Layer	Zoo

Refresh D2D | Config Summary | Aug 26 08 0

Gap: 0.00 (hrs.) | Time Duration(hrs.) 0.25

Rate | 0.00 3.00 6.00 9.00 12.00 1

NAME	RATE	QPE	RFCFFG GUID

NO DATA Retrieved.
This could be due to :
– the filter value for the attribute used for ranking
– no FFG for an FFG–based attribute used for ranking
– an insufficient Duration or a Duration with a large gap
– or it could mean that there is truly no data available.

If you believe there is data, try the following:
– Adjust the filter value (right click on column title used for rank
– Change the rank attribute to qpe
– Adjust the Duration (adjust the Time Duration slider)

If you see the "NO DATA Retrieved" message in place of the body of the table (with accompanying suggestions), please check those suggestions first before concluding that there is a problem that needs to be investigated.

Here is an overview of the basin table sections and functionality associated to each section:

Menu Bar

File	Config	D2D	Layer	Zoom	CWA	Click

Basin Table Menus		
Menu	**Selection**	**Definition**
File	Retrieve Default	Retrieve the default display configuration.
	Retrieve Config	Retrieve the user-named display configuration.
	Save Config As	Save the display configuration as the user-provided name.
Config	Link to Frame	`ON`: The valid time in the FFMP Basin Table will always match the time in the parent D2D frame. If the user changes the frame in the D2D, the Basin Table will update automatically to match the data time shown on the D2D.
		`OFF`: The valid time in the FFMP Basin Table will always be the most recent inventory time. No matter what frame is being viewed in the D2D.
	Worst Case	`ON`: Aggregate (ie: County, HUC_#) values will be the same as the 'worst' small basin in the aggregate. NOTE: The 'worst' basin for qpe may not be the same small basin as the worst basin for guidance, so things like ratio or diff may not *appear* to calculate accordingly, but they are indeed correct.
		`OFF`: Aggregate values will be area-weighted averages of all small basins in the aggregate.
	Auto-Refresh	`ON`: Will automatically update the D2D color image whenever the display configuration has changed. This **may** yield poorer performance.
		`OFF`: Any time the display configuration changes in a way that can be reflected in the color image, the Refresh D2D button will be activated and must be clicked in order to have the D2D color image update according to the new display configuration.

D2D	qpe/ratio/diff	This selection instructs the D2D color image which display type to use for coloring and valuing. If ratio or diff is chosen, then a guidance source must also be chosen (below). NOTE:
		`ratio = qpe / guid *100%`
		`diff  = qpe - guid`

	Guid list	Below a separator below the qpe/ratio/diff selection, you will see a list of all Guidance sources in FFMP. One of these must be chosen when ratio or diff is selected as the D2D Display Type.

Basin Table Menus		
Menu	**Selection**	**Definition**
Layer	All & Only Small	The data in both the Color Image and the Basin Table will be for only the small basins – no aggregates.
	County	The data in both the Color Image and the Basin Table will be aggregated into County values, according to the Worst Case toggle.
	HUC_#	The data in both the Color Image and the Basin Table will be aggregated into HUC auto-aggregated values. Auto-aggregation is conducted via the Pfafstetter small basin identifiers. The HUC number is an arbitrary differentiation between more or less aggregated layers, as noted in the widget labels.

Zoom

Maintain Layer, Only Basins in Parent: When an aggregate layer is chosen, and the user zooms in on an aggregate entity, these two settings will work in tandem to yield the following behavior:

Maintain Layer	Only Basins in Parent	Behavior
OFF	ON	When you click on a Name of an aggregate in the Table Body, the Color Image will zoom into that area in the D2D and display only those small basins that exist **in** the parent area you just zoomed in on, but not any small basins outside that area of interest.
OFF	OFF	When you click on a Name of an aggregate in the Table Body, the Color Image will zoom into that area in the D2D and display all small basins within the field of view. Take care in using this, as when you zoom in you may find it hard to see your landmarks (and county boundaries) and you may lose where you are.
ON	OFF	When you click on a Name of an aggregate in the Table Body, the Color Image will zoom into that area in the D2D and display all areas of your chosen Aggregation Level in the field of view. You will continue to see whatever layer you have chosen from the Layer menu.
ON	ON	These settings are not really of any use. With these, when you zoom in on an area, you will only see that area and not any small basins.

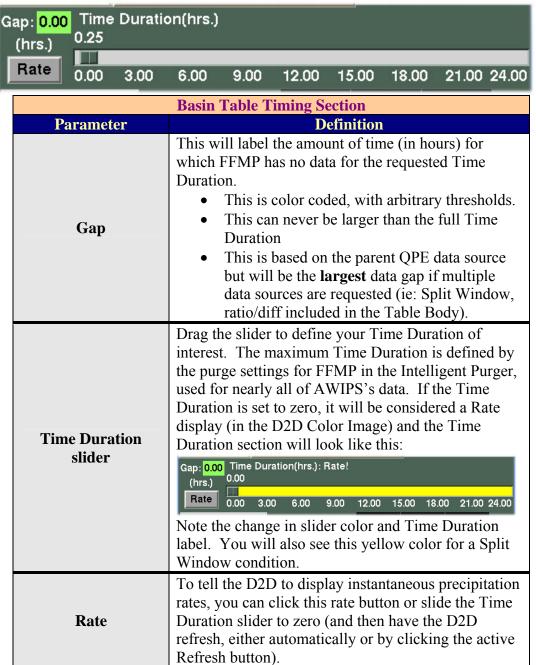| Basin Table Menus		
Menu	Selection	Definition
CWA	*CWA list*	FFMP will trim the data both in the Basin Table and the Color Image according to which CWAs have been 'turned on' (including a small boundary around the area of interest).
Click	Up/Down Trace, Upstream Trace, Downstream Trace, Basin Trend	You can activate (make editable) the D2D Color Image by **middle-clicking** the legend text in the lower right of the D2D display frame. Once this is activated, a **right-click** over a basin on the D2D map will yield whatever is chosen in the Click menu. See the Basin Trace and Basin Trend sections for details.

Utility Bar

Basin Table Utilities	
Utility	**Definition**
Refresh D2D	If Auto-refresh is off, this button will become active when the display configuration has changed in a way that will affect the D2D Color Image, and must be clicked in order to get the D2D Color Image to update/refresh itself.
Config Summary	Click on this to yield a summary of various display configuration settings. This can be helpful when troubleshooting. Here is an example of the pop-up you will see:
Data Time	This label is the valid data time of the data being displayed in the Basin Table.
Clear Trace	If you have created a Basin Trace in the D2D display pane, clicking this button will erase that trace. (See the Basin Trace section.)

Timing Section

Basin Table Timing Section	
Parameter	**Definition**
Gap	This will label the amount of time (in hours) for which FFMP has no data for the requested Time Duration. • This is color coded, with arbitrary thresholds. • This can never be larger than the full Time Duration • This is based on the parent QPE data source but will be the **largest** data gap if multiple data sources are requested (ie: Split Window, ratio/diff included in the Table Body).
Time Duration slider	Drag the slider to define your Time Duration of interest. The maximum Time Duration is defined by the purge settings for FFMP in the Intelligent Purger, used for nearly all of AWIPS's data. If the Time Duration is set to zero, it will be considered a Rate display (in the D2D Color Image) and the Time Duration section will look like this: Note the change in slider color and Time Duration label. You will also see this yellow color for a Split Window condition.
Rate	To tell the D2D to display instantaneous precipitation rates, you can click this rate button or slide the Time Duration slider to zero (and then have the D2D refresh, either automatically or by clicking the active Refresh button).

Column Titles

Basin Table Column Titles		
Parameter	**Definition**	
Column Titles	Each column of data in the Table Body has a black label at the top. Attributes associated with a non-QPE data source will have an additional Source ID label. The following functions are available via the Column Titles (except for the Source labels):	

Function	Action	Description
Rank	**Button1 (left)**	Re-rank the Table Body according to the clicked Column attribute. Direction is unidirectional. The color background will change to a **purple** color for the attribute currently being used for ranking.
Edit Thresholds	**Button3 (right)**	Launch the Threshold Editor. See the Attribute Threshold Widow section for details.

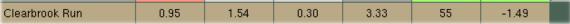|		
Group Label	The gray box above the Name column will display an aggregate name, when you are viewing an aggregate's small basin contents in the Basin Table – ie; after a Zoom-and-Recenter action.	
Attribute Inclusion/Exclusion	The <- widget is a clickable button, which yields a list of attributes that are available for use in the Basin Table. See the Attribute Inclusion/Exclusion section for details.	

Table Body

VA,FREDERICK	3.11	1.80	0.40	2.96	63	-1.24
WV,HAMPSHIRE	2.81	1.57	0.30	2.98	57	-1.38
WV,HARDY	2.53	1.51	0.20	2.96	53	-1.54
MD,FREDERICK	1.35	1.20	0.30	3.50	41	-2.17
VA,CLARKE	0.44	0.93	0.20	2.96	31	-2.30
WV,BERKELEY	1.71	0.57	0.40	3.17	29	-2.36
VA,WINCHESTER	0.49	0.55	0.30	3.33	25	-2.48
VA,NORTHUMBERLAND	1.18	0.22	0.30	3.44	15	-3.02
VA,LOUDOUN	0.35	0.36	0.20	3.40	15	-3.09
WV,JEFFERSON	0.37	0.40	0.30	3.36	14	-3.02

The Table Body lists the FFMP data in tabular form, and can include any of the attributes listed in Appendix A that the user wishes to include. The data is ranked according to a selected attribute (see the Column Titles section above) and can be color-coded by user-defined value thresholds (see the Attribute Threshold Window section). Here are some things you can do in the Table Bobdy:

Basin Table Body		
Function	**Action**	**Description**
Zoom In	Button1 (left) on an entity **Name**	Zooming in on an aggregate utilizes the Zoom menu toggles when zooming in on the D2D Color Image. Zooming in on a small basin just zooms the D2D Color Image further in.
Zoom Out	Button1 (left) on a Group Label or Inspection Row Name.	**Group Label**: Zooms all the way out.
		Inspection Row: Zooms one step out from all the way in.
Basin Trend	Button3 (right) on an entity **Name**	Yields a Basin Trend. See the Basin Trend section for details.
Color Coding	Most of the tabular cells are color coded according to a couple of rules:	
	Rule	**Details**
	Value Threshold	All columns' data, except the Guidance value columns', are color coded according to the thresholds defined in the Attribute Threshold Window, with the typical 'traffic light' pattern.
	Forced Guidance	When values have been forced using the Forced FFG GUI for a guidance source, that value's table grid cell background in the 'guid' column is colored light orange.
	VGB	When a listed aggregate contains a VGB, or if a VGB is listed itself, the Name table grid cell background will be purple.

Inspection Row

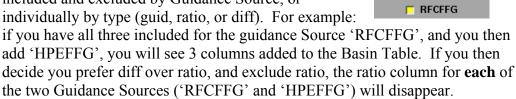| Clearbrook Run	0.95	1.54	0.30	3.33	55	-1.49	

When the Basin Table is used to zoom in on a small basin, that small basin's data row will be duplicated in the Basin Table in the Inspection Row (at the bottom of the Basin Table). The Name in the Inspection Row can be used to zoom out (one step), as well as launch a Basin Trend. There will be no color coding in the InspectionRow.
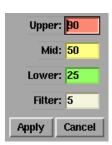
Attribute Inclusion/Exclusion

When you click on the `<-` widget just outside the upper right corner of the Table Body, you will get a windowed listing of attributes (which will include QPF and Guidance source lists), from which you can choose what to include in the Basin Table display. There are two special cases to note:

- Only **one QPF source** can be included at any given time.
- The items that are associated to Guidance can be included and excluded by Guidance Source, or individually by type (guid, ratio, or diff). For example: if you have all three included for the guidance Source 'RFCFFG', and you then add 'HPEFFG', you will see 3 columns added to the Basin Table. If you then decide you prefer diff over ratio, and exclude ratio, the ratio column for **each** of the two Guidance Sources ('RFCFFG' and 'HPEFFG') will disappear.

Attribute Threshold Window

The Attribute Threshold Window is launched by clicking a valid Column Title in the Basin Table. In this window, you can define 4 thresholds for the attribute of interest (except the 'guid' columns, as they are not multi-colored). The 'Lower', 'Mid', and 'Upper' thresholds control what color to render for the background of each of the Basin Table grid cells. The 'Filter' threshold can be used to eliminate the 'unimportant' records from the Basin Table display, so the Basin Table does not get cluttered with 'unimportant' entities.
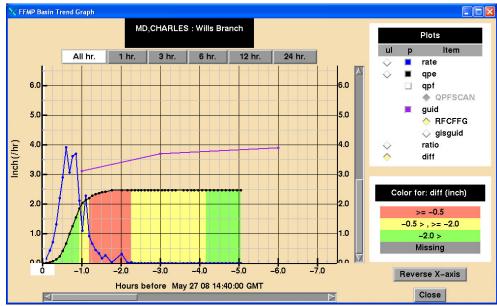
Basin Trend

Above is an example of a Basin Trend. This is launched either from the D2D Color Image (when the Click menu is set to 'Basin Trend' and the D2D Color Image has been made editable/interactable by middle-clicking the lower right Legend text) or by right-clicking (button 2) a **small basin** name in the Basin Table Body. Currently, Basin Trends only work for small basins and not aggregates.

You will see some standard labels, such as the name of the small basin or VGB of interest at the top and axis labels to the left, right, and bottom. Note that the x-axis represents time in the past from the labeled Data Time. Also note something new as of OB9: The current time emphasis, which consists of a white background behind the appropriate x-axis label, and a vertical white line in the background, behind all plots and grid lines.

Here are some things you can do with the Basin Trend:

Basin Trend Functions		
Function	**Action**	**Description**
Toggle Plot on/off	□ Click **square** by plot label	In the 'Plot' legend, you can toggle a plot by clicking the square to the left of the plot name, in the "p" column. The square color will match the plot color. **Note**: Only one QPF or Guidance source can be plotted at any given time. **Note**: No plots are available for ratio/diff. **Note**: Some plots are dependant on others (and may be grayed out until its dependent is toggled on): • ratio/diff dependent on guid • qpf dependent on guid

Basin Trend Functions		
Function	**Action**	**Description**
Change Underlay	◊ Click **diamond** by plot label	In the 'Plot' legend, you can choose an underlay by clicking the diamond to the left of the toggle plot squares, in the "ul" column. The underlay is the color rendered from one of the plots in the trend down to the x-axis. **Note**: When you change the underlay, the Underlay Legend will change as well. **Note**: The thresholds used for the underlay color are the same as the Attribute Thresholds in the Basin Table and can be defined in the same manner.
Reverse X-Axis	Click Reverse X-axis button	The origin of the trend plot can switch from the lower left to lower right, producing basically a mirror image of the plot before the x-axis switch.
View more trend	Scroll or click/drag	In addition to using the scroll bars to view more of the Basin Trend, you can also click-and-drag anywhere in the body of the graph
Choose Alternate Basin Trend Graph	Click button under title	You can choose to view an Alternate Basin Trend Graph (or to go back to the 'original' view) by clicking on one of the buttons under the Basin Trend Graph title. "All" represents the original graph that shows for all Guidance times, and the individual hourly buttons represent the time frame noted on the button label. The button chosen will remain highlighted. See the Alternate Basin Trend Graph section for details.

QPF Plot Interpretation

The Basin Trend has always been a tough thing to become familiar with. Many FFMP users have stated that it takes some time to get used to how the Basin Trend presents its data. The interpretation of the QPF plot is even more challenging.

The goal here was to be able to plot the QPF plot on the **same graph** as everything else and have it still be meaningful and provide scientific value. Several ideas were tried, and the best idea is what you see now in FFMPA. Improvements on QPF plot methods are still under discussion, but until any meaningful conclusions come from that discussion, we have the QPF plot that we have.

The best suggestion we can make in finding the most value when viewing the QPF plot is: keep in mind that its **comparison to Guidance data is the key**. Try to interpret the QPF plot in relation to the Guidance plot – not necessarily the x-axis (time). This example provided can be interpreted like this:

- Let's assume the Time Duration of interest is 3 hours (highlighted in image).
- Comparing the 3-hr Guidance to the 3-hr QPE yields a difference of approximately -1.2 inches, which may imply that guidance is not yet approached and a flash flood situation may be out of the question.
- Comparing the 3-hr Guidance to '2-hr QPE plus 1-hr QPF' yields a difference of approximately +0.05 inches. Taking the QPF value (approximately 1.3 inches) into account (and assuming you trust it) can give you more confidence to make a warning decision sooner.

Alternate Basin Trend Graphs

Due to the added complexity of plotting the QPF data on the original Basin Trend Graph, an alternate presentation was proposed by the field and implemented in OB9, which is hour-specific.
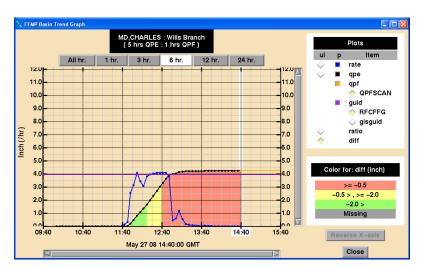
Differences to note in the alternate graphs:

- Only one time frame is used. This means there is only one Guidance value (one time frame) to apply
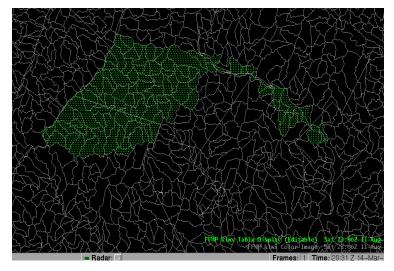
to the entire graph. This also means the user needs to choose their time frame of interest before viewing these alternate graphs.

- The zero plot point is in the past – at the start of the time frame window, and the maximum accumulation is to the right. This may be more familiar to those used to looking at hydrographs.
- The x-axis labels are real-time labels, not hour differences from current time.
- There is no scrolling. The entire graph is visible.
- You cannot change the x-axis direction.
- When QPF is added to the graph, note that:
    - the sub-title label describes the Split Window,
    - the Current Time is shifted and the future time is now the furthest to the right,
    - QPF is directly added to QPE, making interpretation hopefully easier.
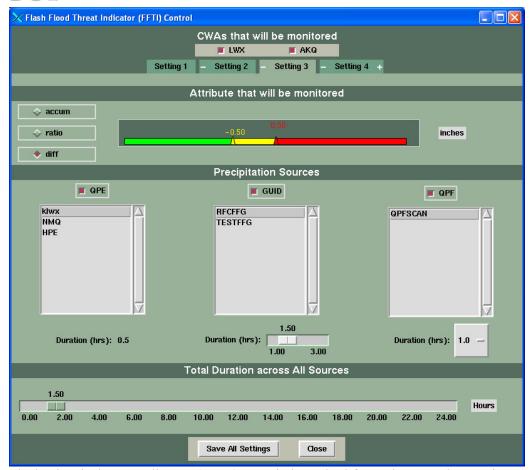

Basin Trace

If the Click menu is set to anything but Basin Trend and the Color Image has been made editable/interactable by middle-clicking the legend text in the lower right corner of the D2D pane, you can right-click (button 2) over the basin of interest in the D2D Color Image and produce a Basin Trace (upstream, downstream, or both), as long as your click was within the FFMP domain. The image to the right is an example of an Up/Down stream Trace.
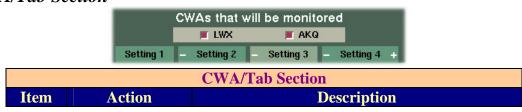
-FFTI GUI-

The Flash Flood Threat Indicator (FFTI) GUI is launched from the "FF" button in Guardian (double-click) and is used to define the Monitor Set(s) that FFMP will monitor. Each time the FFMPprocessor receives a notification of new pertinent data, it will try to evaluate all Monitor Sets that have been defined for a real-time sliding ten-minute window. In other words, for each Monitor Set that has been defined by the FFTI GUI, the FFMPprocessor will determine the 'worst' case over the past 10 minutes and report that to Guardian, using the 'worst' Set priority.

CWA/Tab Section

CWA/Tab Section		
Item	**Action**	**Description**

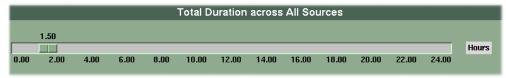| CWA/Tab Section		
Item	**Action**	**Description**
CWA	toggle	FFMP will apply these defined Monitor Sets to the CWAs that are toggled on. Changes here will take effect the next time the FFMPprocessor receives a data notification and cycles. Thus, you can change **Service Backup** coverage for the FFMP Monitor function on-the-fly. Note that the geographic buffer or boundary areas are included as part of the CWA.
Tabs	Select	Click the desired 'Setting' to view and edit the attributes for the chosen Monitor Set.
	Add Set	Click the "+" to the right of the last Set.
	Remove Set	Click the "-" to the left of the Set to be deleted.

Attribute/Threshold Section

Attribute/Threshold Section		
Item	**Attribute**	**Description**
Type	**accum**	Precipitation accumulation will be monitored.
	ratio	The ratio between the precipitation accumulation and guidance will be monitored. (*QPE/GUID *100%)* This will also activate the GUID section below.
	diff	The difference between the precipitation accumulation and guidance will be monitored. (*QPE - GUID*) This will also activate the GUID section below.
Thresholds	Values	There are 2 thresholds to slide to the desired values, separating the three expected color levels. Note that, although the color scheme presented in the FFTI GUI is the traffic light scheme, Guardian allows for the definition of any colors, which will be used to color the FF button in Guardian with the 'worst' color for all Monitor Sets.
	Units	Will display the proper units, dependent on the Type chosen.

Data Source Section

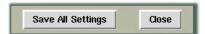| Data Source Section		
Item	**Attribute**	**Description**
QPE	Flag	(Not clickable.) Will appear 'on' when QPE is in use. The only time QPE will not be in use is when QPF is being used for the entire chosen Total Time Duration.
	Source List	Lists all QPE data sources available to FFMP, defined in the $FXA_DATA/ffmpFFMPsourceConfig.dat file.
	Duration	**Automatically calculated** from the other Duration settings.
GUID	Flag	(Not clickable.) Will appear 'on' when GUID is in use, which is when ratio or diff has been chosen.
	Source List	Lists all Guidance data sources available to FFMP, defined in the $FXA_DATA/ffmpFFMPsourceConfig.dat file.
	Duration	A slider will be provided, that will range from the lowest to the highest duration available for the chosen Guidance source, with some arbitrary low-end extrapolation (ie: adding a ½ hour of 1 hour is available). Changing this slider value will also change the Total Duration value.
QPF	Toggle	To enable a Split Window scenario, toggle the QPF section on and choose a duration. This means the Monitor Set will use a combination of QPE and QPF when calculating accumulations (applied to any chosen Type). If you wish, you can monitor only QPF, by setting the Time Duration so that it is all QPF and no QPE.
	Source List	Lists all QPF data sources available to FFMP, defined in the $FXA_DATA/ffmpFFMPsourceConfig.dat file.
	Duration	Once chosen will lead to a re-calculation of the QPE Duration.

Total Duration

This widget will always tell you what the entire time frame is for your Monitor Set, no matter what elements are or are not included. This is also linked to the Guidance Duration, if Guidance is included in the Monitor set.

Examples: For 'ratio', 3-hour Guidance is being compared to (2-hr QPE + 1-hr QPF), the Total Duration slider will show 3.00 hours. For 'accum', 1.5-hr QPE is being added to 1-hr QPF, the Total Duration slider will show 2.50 hours.

If you have enabled a Split Window (ie: included QPE in your Monitor Set), the slider channel will be yellow.
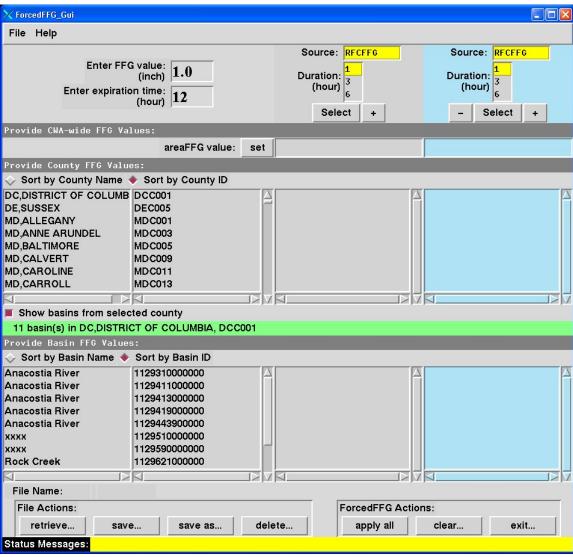
Bottom Section

Once you have defined all of the Monitor Sets you wish, you can click the "**Save All Settings**" button and the GUI will check for duplicate Monitor Sets and activate the Monitor Sets if no duplicates are found. If one or more duplicates are found, a message pop-up will appear informing the user that duplicates are not allowed and which Monitor Sets have been duplicated. The "**Close**" button simply closes the window and exits the program without applying or saving any potential changes.
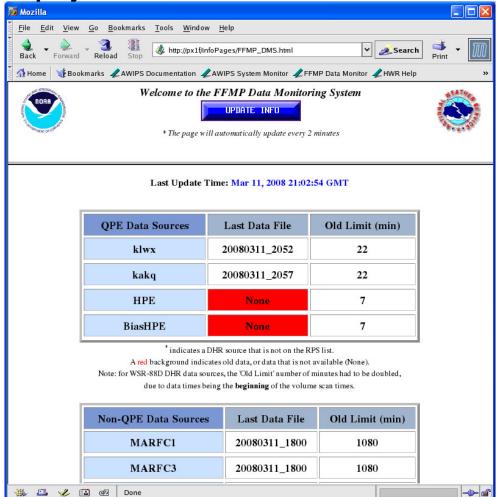
-FFFG GUI-

The Forced Flash Flood Guidance GUI has its own User's Guide. Please see the FFMP web page for details.

-DATA MONITOR SYSTEM-

The FFMP Data Monitoring System (DMS) is a web browser-based, automated system for monitoring the status of the defined FFMP data sources. You can use the DMS to see if the raw data that is being used by FFMP is updating properly or is too old to be used by FFMP.

DMS Display

The FFMP DMS display is divided into two frames. A small, static frame at the top of the page holds the title information and the button for updating the table information. The lower frame provides two lists: one for QPE data sources and one for Non-QPE data sources. Each list will display the most recent data file time and whether the data is being updated in a timely manner or not. This applies to the data FFMP **ingests** (not the data FFMP produces).

If the data is too old, it will be flagged red. "Too old" is determined by the settings in the $FXA_DATA/ffmp/FFMPsourceConfig.dat file.

Using the FFMP DMS

Loading

The FFMP DMS gets launched From the AWIPS browser Quick-launch bar, with the button labeled "FFMP Data Monitor".

Update

- **Automatic:**
  The FFMP DMS will automatically update itself every two minutes, while it is loaded into the browser.
- **Manual:**
  In the static frame at the top of the display, there is a blue button labeled "UPDATE INFO." Clicking this button will refresh the information displayed in the lower frame.

-HELP-

- Please check the FFMP web page for more detailed information and additional documents at http://www.nws.noaa.gov/mdl/ffmp.
- To report problems with FFMPA, please contact the NCF.
- If you have questions regarding the operation of FFMP in general, please send e-mail to the FFMP list server: awips-ffmp@infolist.nws.noaa.gov. If you are not subscribed to the FFMP list server, you can sign up from your Lyris account. There is a link on the FFMP web page to point you in the right direction.
- If you have a more involved question, you can also contact FFMPA developers directly, starting with Tom: Tom.Filiaggi@noaa.gov.

-GLOSSARY-

Glossary	
Acronym	**Definition**
CWA	County Warning Area
D2D	Display 2 Dimensions
DHR	Digital Hybrid Reflectivity
FFFG	Forced Flash Flood Guidance
FFG	Flash Flood Guidance
FFMP	Flash Flood Monitoring and Prediction
FFMPA	Flash Flood Monitoring and Prediction: Advanced
FFTI	Flash Flood Threat Indicator
GUI	Graphical User Interface
HUC	Hydrologic Unit Code
RFC	River Forecast Center
RPS	Routine Products Set
VCP	Volume Coverage Pattern
VGB	Virtual Gage Basin

-APPENDICES-

Appendix A: Available Basin Table Attributes

Available Basin Table Attributes		
Attribute	**Units**	**Description**
name	text	Name of the small basin or aggregate.
rate	in/hr	Instantaneous Rate – meaning the rate representative of the time from the previous data time to the current data time.
qpe	in	Quantatative Precipitation Estimate – an accumulation for the chosen Time Duration.
qpf	in	Quantatative Precipitation Forecast - an accumulation for the provided time frame.
guid	in	Guidance value - an accumulation for the provided time frame, that is suggested as some sort of guidance variable or threshold for a phenomena, like Flash Flooding (ie: "bankful") or Debris Flow.
ratio	%	qpe/guid x 100 – the ratio of qpe to guidance.
diff	in	qpe – guid – the difference between qpe and guidance.